

REMARKS

The specification has been amended to include the priority claim as stated in the Declaration (see section 3 on page 2 of the Declaration).

Claims 8, 9, 13, 15-17, 23-27, 29, 35, 36, 38, 48, 52, 53, 69, and 70 were previously canceled without prejudice to their merit.

Previously withdrawn method claims, Claims 19-22, 28, 30-33 and 56-66, have been canceled herein without prejudice to their merit. Applicants reserve the right to pursue canceled subject matter in one or more continuing applications.

Claims 1-7, 10-12, 14, 18, 34, 37, 39-47, 49-51, 54, 55, 67, and 68 remain in the application and are under consideration.

Rejection of Claims 1-7, 10, 18, and 67 under 35 U.S.C. 103(a) over Durham (U.S. Patent 6,162,228), Catamo (WO 97/13467), Haynor (U.S. Patent 6,216,028), and Gilbert (U.S. Patent 5,731,996)

This rejection is traversed on two separate grounds.

The first ground of traversal is that the combination of prior art fails to teach all the recited limitations. Claim 1 recites a sensor for sensing the three-dimensional orientation of a magnet wherein the sensor comprises an array of sensors dimensioned and configured to detect the x-axis, the y-axis, and the z-axis. "Three-dimensional orientation" as recited in the claims includes both translational and rotational positioning of an object. This meaning of "three-dimensional orientation" is evident throughout the specification. For example, the specification states that "three-dimensional orientation" is defined relative to the x-, y-, and z-axes, with the z-axis being parallel to openings of the hollow object:

The magnet 30 is designed to be axisymmetric with non-circular flux lines. The north pole of the magnet 30 must face medially (along the z-axis 36) so that it projects a magnetic field having a central line 37 of flux parallel to the axes 35, 39 of the interlocking screw openings 12, 14. Designed in this manner, the flux field 50 (shown in FIG. 2) of the magnet 30 relates information about its three-dimensional orientation along the x-axis 41, the y-axis 43, and the z-axis 36. (page 16, lines 16-22 of specification; emphasis added)

The specification explains such information about the object's three-dimensional orientation along the x-axis, the y-axis, and z-axis as comprising both "translational" and "rotational" information:

Because the sensors 44 are aligned in opposing pair members, centering each pair over the target magnet 30 elicits the same magnitude output from each member of the pair. Upon exact centering, one member will "cancel out" the other member. Any deviation from exact center, in either rotation or translation, will cause an offset in opposing members of the sensor pair.

By comparing voltage offset between opposing sensors in the array 42, the direction in the field can be determined... [T]he targeting device 40 allows centering with feedback of offset in the x-y plane, while providing feedback of rotation about x, y, and z axes 41, 43 and 36. (page 20, lines 5-17 of specification, in relevant part; emphasis added)

Thus, as disclosed in the specification, "three-dimensional orientation" comprises translational offset in the x-y plane and rotational offset about the x-, y-, and z-axes.

Translational offset refers to the location of the object in space along an x-y plane, *i.e.*, whether or not an object is positioned directly underneath the targeting device.

Rotational offset can be illustrated by the terms "yaw," "pitch," and "roll" as used in aviation. These concepts are explained in Exhibit A, attached hereto. "Yaw" is defined relative to a vertical axis (*e.g.*, a z-axis) and is used to describe whether an aircraft's nose is pointed to the left or the right. "Roll" is defined relative to a second horizontal axis (*e.g.*, an x-axis) passing through a plane from nose to tail and is used to describe whether an aircraft's wings are tilted from a horizontal position. "Pitch" is defined relative to a first horizontal axis (*e.g.*, a y-axis) passing through a plane from wingtip to wingtip and is used to describe whether an aircraft's nose is pointing down or up. In the present case, rotational positioning of the recited hollow object refers to the yaw, roll, or pitch of the hollow object relative to the targeting device.

In sum, the recitation that the sensor senses the three-dimensional orientation of the magnet in Claim 1 requires that the sensor be capable of providing both translational and rotational information.

The Office has cited Gilbert for teaching a device comprising a sensor array and employing a processor capable of determining the three-dimensional orientation of a magnet. See page 4, lines 7-11 of second full paragraph of Office Action dated January 22, 2010. Gilbert, however, does not teach a device capable of determining the three dimensional orientation of a

magnet as defined by the current specification. Specifically, Gilbert does not teach a device capable of providing information regarding the rotational position of an object. Gilbert teaches a device capable of providing only information regarding the translational position of an object.

That Gilbert teaches a device capable of providing only information regarding the translational position of an object is evident from Gilbert's emphasis in determining the **location** of an object. For example, Gilbert states:

The present invention implements a method that simultaneously processes magnetic field measurements taken from an array of sensors to estimate the likelihood of one or more magnetic dipole sources at particular **locations in three-dimensional space**. (column 1, lines 53-57 of Gilbert; emphasis added)

In more specifically describing the method, Gilbert states:

In the present invention, (a) a set of actual magnetic field measurements of a magnetic dipole is collected using a plurality of magnetic sensors. Then (b), a **location** for the magnetic dipole is hypothesized. Then (c), a set of estimated magnetic field measurements is determined that would be formed by a magnetic dipole at the hypothesized **location**. Then (d), the actual magnetic field measurements are compared with the estimated magnetic field measurements. Steps (b) through (d) are repeated for all hypothesized **locations** within the detection range of the array of magnetic sensors. (column 2, lines 55-58 of Gilbert; emphasis added)

Also see throughout the Detailed Description for other teachings directed specifically to determining the **location** of an object: column 3, lines 45-66 and especially lines 60-63 of Gilbert; column 4, lines 1-24, especially lines 10-23; column 4, lines 25-28, wherein Gilbert describes an equation for determining the magnetic field of an object "at a point in space"; column 7, lines 6-8; column 7, lines 23-24; column 7, lines 63-65; and column 7, lines 66-67, regarding the "spatial processing" of magnetometer data. In contrast to the focus on determining the location of an object in space, Gilbert is completely silent regarding detecting the rotational position of an object.

In view of the foregoing, Gilbert does not teach a system capable of determining the three-dimensional orientation of a magnet, as required by Claim 1. Further, as explicitly stated by the Office, the combination of Durham, Catamo, and Haynor does not teach a sensor capable of sensing the three-dimensional orientation of a magnet in a manner consistent with the other recited limitations in Claim 1. See page 4, lines 1-7 of second full paragraph of Office Action

dated January 22, 2010. Thus, Claim 1 and dependent Claims 2-7, 10, 18, and 67 are not obvious over the combination of Durham, Catamo, Haynor, and Gilbert.

The second ground of traversal is that the proposed combination of Gilbert with Durham is improper.

The Office has proposed modifying Durham to comprise the processor taught by Gilbert. See page 4, last line through page 5, line 4 of Office Action dated January 22, 2010.

However, Gilbert is directed to a system for detecting the three dimensional position of an object based on movement of the object relative to sensors. This is evident in the following passage by Gilbert:

The present invention places no such restrictions on geometrical arrangement and tolerates the placement of sensors anywhere in three-dimensional space. The advantage is that systems of sensor arrays may be designed to optimize the area of coverage and detection performance. Synthetic arrays are generated by taking periodic measurements from a single sensor in motion. The present invention permits processing of synthetic arrays regardless of the complexity of the geometrical motion. The advantage is that the trajectories used are not limited to straight lines and simple arcs, but that any path of motion may be processed. (column 2, lines 43-54 of Gilbert; emphasis added)

Further, in describing the processing in detail, Gilbert teaches that the processing begins with a set of sensor data derived from magnetic field measurements by sensors that detect a “moving dipole.” See column 3, lines 45-65, especially lines 56-60, and FIG. 1. Gilbert does not describe that the processing method can be used to determine the location of a dipole that is static with respect to the array of sensors.

Modifying Durham to include a processor that detects the location of an object based on that object’s movement in space would render Durham unsatisfactory for its intended purpose. This is improper as established by *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). See MPEP §2143.01(V). Durham is directed to locating and targeting the holes in orthopedic rods to enable proper positioning of screws and pins within the holes. The orthopedic rods are used in treating fractures of bones. Durham teaches that the locking screws or pins must be “precisely located” so that the load on the limb involved is transmitted, during healing, through the transverse screws or pins and the associated locking rod and not through the broken portion of the bone. See column 1, lines 23-38 of Durham. Adding the processor of Gilbert to the device

of Durham would not enable Durham's device to precisely locate the holes in the orthopedic rod because movement of the orthopedic rod would be required to detect the position of the holes. Thus, the present rejection is improper because the proposed modification of Durham to include Gilbert's processor would render Durham unsatisfactory for its intended purpose.

Furthermore, Durham explicitly teaches against use of devices that involve movement in determining the location of the transverse locking holes in the orthopedic locking rod. Durham mentions the use of x-rays to locate the transverse locking holes. Durham, however, states that "the need to move the x-ray equipment into and out of position to check the screw or pin location means that there is a risk of a loss of alignment each time that the equipment is moved" (column 1, lines 42-45 of Durham). To prevent such a loss of alignment, a practitioner in the art would not use the processor of Gilbert with the device of Durham because the processor of Gilbert requires movement of a dipole relative to the sensors for detecting the location of the dipole.

In view of the foregoing, Claims 1-7, 10, 18, and 67 are not obvious over Durham, Catamo, Haynor, and Gilbert. Withdrawal of this rejection is requested.

Rejection of Claims 11 and 12 under 35 U.S.C. §103(a) over Durham, Catamo, Haynor, Gilbert, and Putative Admission

This rejection is traversed.

Claims 11 and 12 depend from Claim 1. Claim 1 is not obvious over the combination of Durham, Catamo, Haynor, and Gilbert for the reasons expressed above, which are incorporated in the present remarks by reference. The putative admission does not correct the deficiencies of the combination of Durham, Catamo, Haynor, and Gilbert with respect to Claim 1. Therefore, Claims 11 and 12 are not obvious over the combination of Durham, Catamo, Haynor, Gilbert, and putative admission.

Withdrawal of this rejection is requested.

Rejection of Claim 14 under 35 U.S.C. §103(a) over Durham, Catamo, Haynor, Gilbert, and Hollis

This rejection is traversed.

Claim 14 depends indirectly from Claim 1. Claim 1 is not obvious over the combination of Durham, Catamo, Haynor, and Gilbert for the reasons expressed above, which are incorporated in the present remarks by reference. Hollis does not correct the deficiencies of the combination of Durham, Catamo, Haynor, and Gilbert with respect to Claim 1. Therefore, Claim 14 is not obvious over the combination of Durham, Catamo, Haynor, Gilbert, and Hollis.

Withdrawal of this rejection is requested.

Rejection of Claims 34, 37, 39, 40-47, and 49-51 under 35 U.S.C. §103(a) over Durham, Catamo, Haynor, Gilbert, and Putative Admission

This rejection is traversed.

Claim 34 is identical to Claim 1 except that claim 34 is directed to detecting screw openings within an intramedullary nail and that Claim 34 further recites that the array of sensors comprises aligned, opposing pair members wherein a first distance between members of a first pair of opposing pair members differs from a second distance between members of a second pair of opposing pair members. The device recited in Claim 1 is not obvious over the combination of Durham, Catamo, Haynor, and Gilbert for the reasons expressed above, which are incorporated in the present remarks by reference. The putative admission does not correct the deficiencies of the combination of Durham, Catamo, Haynor, and Gilbert with respect to Claim 1. Because Claim 34 recites at least the limitations recited in Claim 1, Claim 34 and dependent Claims 37, 39, 40-47, and 49-51 are also not obvious over the combination of Durham, Catamo, Haynor, Gilbert, and putative admission.

With regard specifically to the limitations further recited in Claim 34 compared to Claim 1, the Office has cited Catamo for teaching an array of sensors comprising aligned, opposing pair members (see second-to-last line on page 7 through line 2 on page 8 of Office Action dated January 22, 2010). However, the Office has not indicated where the prior art teaches an array of sensors comprising aligned, opposing pair members **wherein a first distance between members of a first pair of opposing pair members differs from a second distance between members of a second pair of opposing pair members**. Because the Office has not indicated such a teaching in the prior art, this rejection is improper.

Furthermore, it would be improper to modify the sensor array of Catamo to comprise aligned, opposing pair members wherein a first distance between members of a first pair of opposing pair members differs from a second distance between members of a second pair of opposing pair members. Catamo explicitly teaches a sensor array containing four individual sensors positioned on a plane in a “simmetric [*sic*] and equidistant (crosswise)” manner (see line 4 of section 28 of Catamo). Claim 34, however, effectively recites a sensor array with sensors configured in a non-equidistant manner. The sensor array of Catamo would therefore have to be modified to include non-equidistant sensors. It would not be obvious to modify the sensor array of Catamo to include non-equidistant sensors. Catamo does not teach or even suggest a sensor array having a non-equidistant configuration. This is because alignment as taught by Catamo occurs when all four sensors are excited with equal intensity (see lines 1-5 of section 32 of Catamo). An equidistant configuration is required by Catamo for detecting the signals induced by the field with equivalent intensity (see lines 4-6 of section 28 of Catamo). Modifying the sensor array of Catamo to include non-equidistant sensors would not permit alignment as taught by Catamo. Thus, modifying the sensor array of Catamo to include non-equidistant sensors would change the principle of operation of Catamo as well as render Catamo’s sensor array unsatisfactory for its intended purpose. Such a proposed modification is improper as established by *In re Gordon* and *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). See MPEP §2143.01(V) and §2143.01(VI).

In view of the foregoing, Claim 34 and dependent Claims 37, 39, 40-47, and 49-51 are not obvious over Durham, Catamo, Haynor, Gilbert, and putative admission. Withdrawal of this rejection is requested.

Rejection of Claims 54 and 55 under 35 U.S.C. §103(a) over Durham, Catamo, Haynor, Gilbert, Putative Admission, and Hollis

This rejection is traversed.

Claims 54 and 55 depend either directly or indirectly from Claim 34. Claim 34 is not obvious over the combination of Durham, Catamo, Haynor, Gilbert, and putative admission for the reasons expressed above, which are incorporated in the present remarks by reference. Hollis does not correct the deficiencies of the combination of Durham, Catamo, Haynor, Gilbert, and

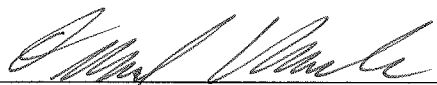
putative admission with respect to Claim 34. Therefore, Claims 54 and 55 are not obvious over the combination of Durham, Catamo, Haynor, Gilbert, putative admission, and Hollis.

Withdrawal of this rejection is requested.

CONCLUSION

In view of Applicants' amendments and Applicants' arguments submitted herein, it is believed that the above-referenced claims are now in condition for allowance. Notification of the same is respectfully requested. In addition, Applicants respectfully request the Examiner to withdraw his prior restriction requirement. If the Examiner has any questions at all with respect to Applicants' response, the Examiner is encouraged to contact the undersigned agent. The undersigned agent welcomes any attempt by the Examiner to come to a resolution of any yet outstanding issues.

Respectfully submitted,



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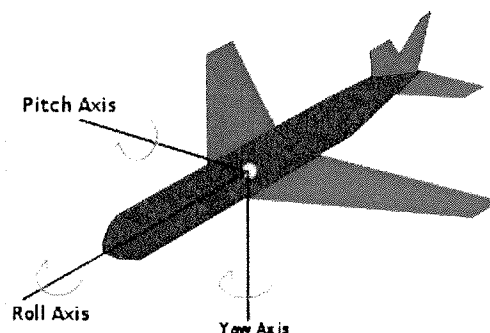
Submission: March 22, 2010

Signature: Betty L. Schubert

Aircraft principal axes

From Wikipedia, the free encyclopedia

In flight, the control surfaces of an aircraft produce aerodynamic forces. These forces are applied at the center of pressure of the control surfaces which are some distance from the aircraft's center of gravity and produce torques (or moments) about the principal axes. The torques cause the aircraft to rotate. The elevators produce a pitching moment, the rudder produces a yawing moment, and the ailerons produce a rolling moment. The ability to vary the amount of the force and the moment allows the pilot to maneuver or to trim the aircraft.



The position of all three axes

These axes move with the aircraft, and change relative to the earth as the aircraft moves. For example, for an aircraft whose left wing is pointing straight down, its "vertical" axis is parallel with the ground, while its "lateral" axis is perpendicular to the ground. Therefore here yaw means an intrinsic motion, as in Yaw rate sensor.

Contents

- 1 The three Aircraft principal axes
 - 1.1 Vertical axis (yaw)
 - 1.2 Lateral axis (pitch)
 - 1.3 Longitudinal axis (roll)
- 2 Relationship with other rotations
- 3 History
- 4 See also
- 5 References
- 6 External links

The three Aircraft principal axes

- Vertical axis, or yaw axis — an axis drawn from top to bottom, and perpendicular to the other two axes. Parallel to the *fuselage station*.
- Lateral axis, or pitch axis — an axis running from the pilot's left to right in piloted aircraft, and parallel to the wings of a winged aircraft. Parallel to the *buttock line*.
- Longitudinal axis, or roll axis — an axis drawn through the body of the vehicle from tail to nose in the normal direction of flight, or the direction the pilot faces. Parallel to the *waterline*.
- Transverse axis — another term for the Lateral axis

Vertical axis (yaw)

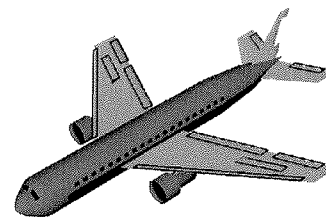
The vertical axis passes through the plane from top to bottom. Rotation about this axis is called **yaw**. Yaw changes the direction the aircraft's nose is pointing, left or right. The primary control of yaw is with the rudder. Ailerons also

Exhibit A

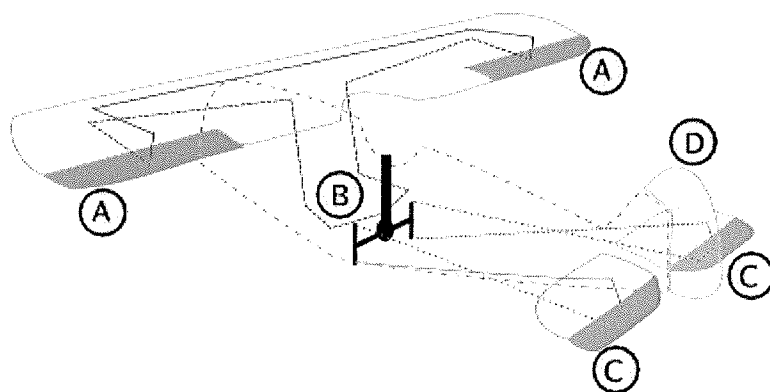
have a secondary effect on yaw.

Yaw axis is a vertical axis through an aircraft, rocket, or similar body, about which the body yaws; it may be a body, wind, or stability axis. Also known as yawing axis.^[1]

The yaw axis is defined to be perpendicular to the body of the wings with its origin at the center of gravity and directed towards the bottom of the aircraft. A yaw motion is a movement of the nose of the aircraft from side to side. The pitch axis is perpendicular to the yaw axis and is parallel to the body of the wings with its origin at the center of gravity and directed towards the right wing tip. A pitch motion is an up or down movement of the nose of the aircraft. The roll axis is perpendicular to the other two axes with its origin at the center of gravity, and is directed towards the nose of the aircraft. A rolling motion is an up and down movement of the wing tips of the aircraft.^[2]

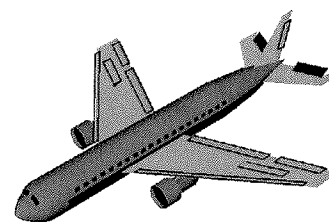


Yaw



Plane control and motion.

Lateral axis (pitch)

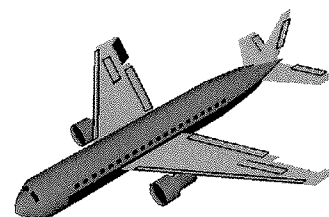


Pitch

The lateral axis passes through the plane from wingtip to wingtip. Rotation about this axis is called **pitch**. Pitch changes the vertical direction the aircraft's nose is pointing. The elevators are the primary control of pitch. Also called Transverse axis.

Longitudinal axis (roll)

The longitudinal axis passes through the plane from nose to tail. Rotation about this axis is called **bank** or **roll**. Bank changes the orientation of the aircraft's wings with respect to the downward force of gravity. The pilot changes bank angle by increasing the lift on one wing and decreasing it on the other. This differential lift causes bank rotation around the longitudinal axis. The ailerons are the primary control of bank. The rudder also has a secondary effect on bank.



Roll

Relationship with other rotations

These axes are related to the principal axes of inertia, but are not the same. They are geometrical symmetry axes, regardless of the mass distribution of the aircraft.

In aeronautical and aerospace engineering they are often called Euler angles, but this conflicts with existing usage elsewhere. They are intrinsic rotations and the calculus behind them is similar to the Frenet-Serret formulas.

These rotations are intrinsic. To perform a rotation in an intrinsic reference frame is equivalent to right-multiply its characteristic matrix (the matrix that has the vector of the reference frame as columns) by the matrix of the rotation.

History

The first aircraft to demonstrate active control about all three axes was the Wright brothers' 1902 glider. [3]

See also

- Aerodynamic
- Flight dynamics
- Tait-Bryan angles
- Flight control surfaces
- Fixed-wing aircraft
- Screw theory

References

1. ^ "Specialty Definition: YAW AXIS". <http://www.websters-online-dictionary.org/ya/yaw+axis.html>. Retrieved 2008-07-31.
2. ^ "Yaw axis". <http://www.answers.com/topic/yaw-axis>. Retrieved 2008-07-31.
3. ^ "Aircraft rotations". <http://www.grc.nasa.gov/WWW/K-12/airplane/rotations.html>. Retrieved 2008-08-04.

External links

- Yaw Axis Control as a Means of Improving V/STOL Aircraft Performance.
- 3D fast walking simulation of biped robot by yaw axis moment compensation
- Flight control system for a hybrid aircraft in the yaw axis

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